UNIVERSITY OF CALIFORNIA, SAN DIEGO

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September 22, 1988

Office of Naval Research
800 North Quincy Street, Code 1111 MA
Arlington, VA 22217-5000

Dear Sirs:

Attached please find my final progress report on ONR Grant:

N000014-85-K-0070
1/1/85 - 12/31/87
J. William Helton, P.I.
Regents of the University of California
University of California, San Diego
Grant titled: Frequency Domain Design of Robust Controllers

Sincerely,

J. William Helton

J. William Helton
Principal Investigator

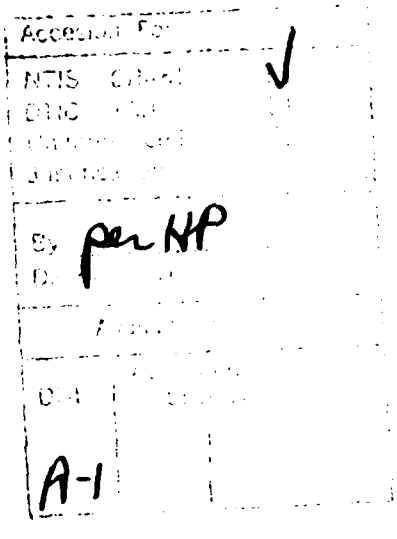
ONR Final Report
N00014-85-K-0070

Attached is a list of papers which were published between 1985 and 1987 during the term of the above referenced grant. Work focused on several areas:

1. Extending a body of classical function theory and operator theory results to non-linear operators. This ultimately might provide a theory for non-linear H^∞ control.

2. Extending the usual theory of H^∞ approximation to complicated performance objectives. Here I do qualitative and numerical work. Physically this amounts to treating problems of the variety that arise industrially in a direct way. Most work in H^∞ control focuses on much more idealized paradigm cases.

3. Approximation of a given matrix from the subspace of matrices with a given sparsity structure.



PUBLICATIONS OF J. W. HELTON
1985-1987

(1)	J. W. Helton and M. Tabor: "On the classical support of quantum mechanical wave functions," *Physicsa D*, **18** (1985), 27-43.	RESEARCH ARTICLE
(2)	J. W. Helton and M. Tabor: "On classica, and quantal Kolmogorov entropies," *J. Stat. Physics.*	RESEARCH ARTICLE
(3)	J. W. Helton and L. Rodman: "Signature preserving linear maps of Hermitian matrices," *Linear and Multilinear Alg.*, **17** (1985), 29-37.	RESEARCH ARTICLE
(4)	J. W. Helton and E. A. Jonckheere: "Power Spectrum reduction by optimal Hankel norm approximation of the phase of the outer spectral factor," *IEEE Trans. Auto. Cont.*, **AC-30** (December 1985), 1192-1201.	RESEARCH ARTICLE
(5)	J. W. Helton: "Worst case analysis in the frequency domain: an H^∞ approach to control," *IEEE Trans. Auto . Cont.*, **AC-30** (December 1985), 1154-1170.	RESEARCH ARTICLE
(6)	J. A. Ball and J. W. Helton: "Beurling-Lax representations using classical Lie groups with many applications III: groups preserving forms," *Amer. J. Math*, **108** (1986), 95-174.	RESEARCH ARTICLE
(7)	J. A. Ball and J. W. Helton: "Interpolation problems of Pick-Nevanlinna and Lowener types for meomorphic matrix functions: parametrization of the set of all solutions," *Integral Equations and Operator Theory*, **9** (1986), 155-203.	RESEARCH ARTICLE
(8)	J. W. Helton: "Optimization over spaces of analytic functions and the Corona problem," *J. Operator Theory*, **15**, (1986), 359-375.	RESEARCH ARTICLE
(9)	J. W. Helton and R. Howe: "A bang-bang principle for the frequency domain," *J. Approx. Theory*, **47** (1986), 101-121.	RESEARCH ARTICLE
(10)	J. W. Helton, D. F. Schwartz and S. E. Warschawski: "Local optima in H^∞ produce a constant objective function," *J. Complex Analysis*, **15** (1986), 359-375.	RESEARCH ARTICLE

(11)	J. A. Ball and J. W. Helton: "Beurling-Lax representations using classical Lie groups with many applications IV: GL(n,r), U*(2n),SL(n,$\mathbb{C}$), and a solvable group," *J. Functional Analysis*, **69** (1986), 178-206.	RESEARCH ARTICLE
(12)	C. I. Byrnes and J. W. Helton: "Cascade equivalence of linear systems," *Int. J. Control*, **44** (1986), 1507-1521.	RESEARCH ARTICLE
(13)	J. Bence, J. W. Helton and D. E. Marshall: "Optimization over H^{∞}," *Proc. of Conference on Decision and Control*, Athens, Greece, December 1986.	RESEARCH ARTICLE
(14)	M. S. Verma , J. W. Helton, and E. A. Jonckheere: "Robust stabilization of a family of plants with varying number of right half plane poles," preprint.	RESEARCH ARTICLE
(15)	J. W. Helton: Operator theory, analytic functions, matrices and electrical engineering, CBMS Regional Conference Lecture Notes, held at Lincoln, Nebraska, August 1985. Regional Conference Series in Mathematics, No. 68, 1987.	BOOK
(16)	J. A. Ball, C. Foias, J. W. Helton, and A. Tannenbaum: "On a local nonlinear commutant lifting theorem," *Indiana Journal of Mathematics*, **36** (Fall 1987), 693-709.	RESEARCH ARTICLE
(17)	J. A. Ball, J. W. Helton and C. H. Sung: "Nonlinear solutions of Nevanlinna-Pick interpolation problems," *Michigan Math. J.*, **34** (1987), 375-389.	RESEARCH ARTICLE
(18)	J. W. Helton and L. Rodman: "Vandermonde and resultant matrices: an abstract approach," *Math Systems Theory*, **20** (1987), 169-192.	RESEARCH ARTICLE
(19)	J. A. Ball and J. W. Helton: "Well posedness of nonlinear causal feedback systems," *Proc. of Conference on Decision and Control*, Los Angeles, December 1987.	RESEARCH ARTICLE
(20)	F. J. Helton, J. W. Helton and J. M. Greene: "On necessary equilibrium conditions for advanced toroidal plasma experiments," *Comments on Plasma Physics and Controlled Fusion* , **Vol XI No. 3** (1987), 119-164.	RESEARCH ARTICLE